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All-in-one nucleic acid testing for point-of-care diagnostics

An ultra-portable diagnostic device which integrates sample preparation, nucleic acid amplification, and visual readouts for rapid, high-accuracy point-of-care testing.

IP Status: Utility Patent Pending; Application No. 18/443,963

Applications

- High-accuracy on-site and at-home diagnostics for a variety of infectious diseases (COVID-19, influenza, etc.)
- Testing in remote or resource-limited settings

Key Benefits & Differentiators

- **High-accuracy diagnostics:** A nucleic acid testing platform offering 1,000 to 10,000 times higher sensitivity than traditional antigen-based tests.
- **Low-cost production:** The device consists of three simple, laser-cut plastic layers, eliminating the need for expensive instruments and significantly reducing costs.
- **Portable and self-contained:** The ultra-compact, lightweight device requires no additional instruments, power sources, or trained operators.

Technology Overview

Accurate and rapid on-site detection of infectious diseases is crucial for effective treatment and pandemic management. However, conventional diagnostic devices face significant challenges in resource-limited or at-home settings, often requiring complex infrastructure, sophisticated instruments, and skilled professionals. Antigen-based rapid tests, while portable and easy to use, are limited by low sensitivity and a high rate of false-negative results, particularly in patients with low viral loads. This reliance on symptom-based diagnosis can lead to delayed treatment, increased transmission, and complex clinical complications.

Researchers at the University of Minnesota have developed a novel nucleic acid testing (NAT) device that provides rapid, accurate, and low-cost diagnostics for point-of-care applications. The device integrates sample preparation, nucleic acid amplification using isothermal methods, and direct visual readouts into a single, compact unit. This all-in-one design, which uses a simple sliding panel mechanism, eliminates the need for any additional instruments or power sources. By utilizing nucleic acid amplification, the technology achieves significantly higher sensitivity and accuracy compared to lateral flow immunoassays, making it a powerful platform for diagnosing a wide range of infectious diseases from various sample types.

Phase of Development

TRL: 4-5
A working prototype has been developed and is undergoing pre-clinical validation.

Desired Partnerships

Technology ID
2022-283

Category
All Technologies
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Life Sciences/Biochemicals & Small Molecules
Life Sciences/Diagnostics & Imaging
Life Sciences/Health IT
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Life Sciences/Research Tools
Software & IT/Health IT

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Researchers

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- **Mark Osborn, PhD** Associate Professor, Department of Pediatrics

References

1. Peng Zhou, Amber McElroy, Yingming Xu, Terrence Simon, Mark Osborn, Tianhong Cui(2025) , https://asmedigitalcollection.asme.org/IMECE/proceedings-abstract/IMECE2024/88681/V010T13A012/1212082, https://asmedigitalcollection.asme.org/imece